Therapeutic Effect of Superficial Acupuncture in Treating Myofascial Pain of the Upper Trapezius Muscle: A Randomized Controlled Trial

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The aim of this study was to compare the treatment efficacies of superficial acupuncture and traditional acupuncture on trigger points of the upper trapezius muscle. Forty people were recruited and randomly allocated to the traditional and superficial acupuncture groups. Each subject received two treatments per week in a four-week period. Outcomes were measured by visual analogue scale (VAS), the Northwick Park neck pain questionnaire scores (NPQ), and pressure pain threshold (PPT) assessments of trigger points. Data collected before the interventions were considered as baseline. Assessments were performed after the first treatment and at the end of the second and fourth weeks of treatment. Patients reported significant (p < 0.05) and immediate improvements in VAS and PPT for both superficial acupuncture and traditional acupuncture after the first treatment and after two and four weeks. Significant improvements (p < 0.05) in NPQ were attained after two weeks of treatments in both groups. Because superficial acupuncture is associated with less pain while producing immediate pain relief, we recommend it for treating myofascial pain syndrome in the upper trapezius muscle.

1. Introduction

Myofascial pain syndrome is a common source of musculoskeletal pain in primary care. About 30% of the patients who visit health care clinics because of pain meet the criteria for myofascial pain syndrome [1]. Commonly seen at muscles that are under prolonged eccentric loading [2], myofascial pain syndrome is characterized by trigger points, which are focal, discrete, and hyperirritable areas in taut bands of muscle fibers, are associated with typical pain referral patterns, and give rise to motor dysfunction and autonomic phenomena [3]. Because of its high prevalence and ease-of-access, the most commonly tested muscle is the upper trapezius muscle, which is implicated in neck and shoulder pain [4].

The formation of trigger points remains elusive. One hypothesis suggests that when excessive acetylcholine is released at the motor end plates, the calcium pump mechanism is disturbed, causing the sustained contraction of sarcomeres in the myofascial and local hypoxia due to blood vessel compression. This mechanism of action conforms to the energy crisis theory [5].

A variety of methods may be applied for treating myofascial pain. The noninvasive treatments include physical therapies, such as heat, massage, transcutaneous electrical nerve stimulations, stretching, and mud baths, or magnetic field application [6, 7]. The invasive methods include intramuscular electrical stimulation, injection therapy, and dry needling. Intramuscular electrical stimulation, or electroacupuncture, is usually performed with acupuncture needles as electrodes, the use of which provides more pain relief and improved functionality than traditional transcutaneous nerve stimulation [8]. Myofascial pain injections are performed with a
2. Materials and Methods

2.1. Design. This study is a parallel designed randomized controlled trial with the allocation ratio of 1:1, conducted at the Keelung branch of Chang Gung Memorial Hospital, Keelung City, Taiwan. It was approved by the Chang Gung Medical Foundation Institutional Review Board (IRB number 106-1472CI).

2.2. Subjects. Sample size calculation was based on a previous study testing the effect of dry needling on upper trapezius muscle [13]. Patients with neck and shoulder pain with VAS scores of two to seven, who were referred for evaluation and treatment from August 2016 to October 2017, were included. Physical examination revealed tender spots within palpable taut bands in the upper trapezius muscle, which showed a referred pain pattern when a pressure of 2.5 kgf/cm² was applied to the taut bands [13].

Participants were excluded if they experienced any of the following criteria: (a) fibromyalgia, whiplash injury, cervical spine fracture, cervical radiculopathy, myeloid type cervical spondylopathy, and cervical spine surgery; (b) systematic disease such as rheumatoid arthritis, multiple sclerosis, or tuberculosis; (c) treatment or therapy for myofascial pain of upper trapezius muscle within the past month before the evaluation; (d) contraindications to acupuncture treatments, such as pregnancy, local infection, current anti-coagulant therapy, and allergy to alcohol or stainless steel (Tables 1 and 2).

All participants were asked to stop any other treatment or therapy for myofascial pain syndrome while they were undergoing the acupuncture treatment and to report any adverse event they experienced. Randomization was performed by lots using opaque envelopes. Investigators ensured the envelopes were opaque when held to the light and opened after the participant’s names were written on the envelopes.

2.3. Assessment and Follow-Up. The VAS score, the Northwick Park neck pain questionnaire, and trigger point pressure threshold were assessed as outcome measures. The first assessment was performed before treatment at baseline. Assessments were then conducted immediately after the first treatment, at the end of the second and fourth weeks after treatment (Figure 1).

2.4. Measurement Instruments. The visual analogue scale is a psychometric response scale for subjective perception of current pain intensity, rated from 0 (no pain) to 10 (most severe pain ever experienced). The Northwick Park neck pain questionnaire has good short-term repeatability, high internal consistency, and sensitivity to change; it measures neck pain and consequent patient disabilities, providing an objective measure to evaluate the outcome and monitor symptoms in patients with acute or chronic pain over time [14, 15]. The participants had to fill in the questionnaire which was divided into nine five-part sections: (1) neck pain...
### Table 2: Characteristics of study subjects.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Number</th>
<th>Sex M/F</th>
<th>Age mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>19</td>
<td>5/14</td>
<td>33.37 ± 9.17</td>
</tr>
<tr>
<td>TA</td>
<td>20</td>
<td>9/11</td>
<td>35.35 ± 10.76</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>14/25</td>
<td></td>
</tr>
</tbody>
</table>

SA, superficial acupuncture; TA, traditional acupuncture.

2.5. Intervention. Participants were allocated randomly into superficial acupuncture or traditional acupuncture groups; they underwent treatment twice weekly for a 4-week period. During treatment, participants were asked to sit with both arms placed naturally alongside the body. A licensed doctor fully instructed the participants on the procedure and then gently wiped the trigger points on upper trapezius muscle with cotton swabs soaked with 75% alcohol.

2.5.1. Superficial Acupuncture. Stainless steel ear acupuncture needles (0.2 mm diameter, 2.5 mm length. “YU KUANG” disposable ear acupuncture needles) were fully inserted perpendicularly into the skin over each trigger point with the depth of 2.5 mm. All needles were left in place for 20 minutes and then removed.

2.5.2. Traditional Acupuncture. Stainless steel acupuncture needles (0.3 mm diameter, 40 mm length. “YU KUANG” disposable acupuncture needles) were inserted perpendicularly into the skin at each trigger point. The needles were inserted and withdrawn several times in each taut band using the pistoning acupuncture technique. One or more localized twitch responses were elicited. Before removal, the needles were...
were inserted in the taut bands with an approximate depth of 1 cm for 20 minutes.

2.6. Statistical Analysis. Measurements of VAS, NPQ, and pressure pain threshold were calculated and presented as means ± standard deviations. The repeated measure ANOVA was used to assess the differences between the data before and after treatments in each group, and post hoc comparisons were performed using Fisher’s least significant difference (LSD). Effect sizes were calculated and reported as eta square ($\eta^2$). The statistical significance was established at $p < 0.05$ (two-sided). SPSS version 22.0 for Windows was used for analyzing all data.

3. Results

The changes in parameters are listed in Table 3. No adverse event was reported by participants.

3.1. Reduced Pain Intensity. According to the changes in VAS, all participants had reduced pain sensation in the upper trapezius muscle. Compared to the data collected at baseline, VAS scores after the first treatment and at the 2 and 4-week follow-up assessments showed significant improvements. A large main effect of time on pain intensity ($p < 0.001, \eta^2 = 0.545$) was observed. The results of both groups revealed that the pain intensity decreased as more treatments were applied (Figure 2). There was no significant time * group interaction ($p = 0.919, \eta^2 = 0.003$).

3.2. Increased Pressure Pain Threshold of Trigger Points. The changes in pressure pain threshold of trigger points revealed a significant objective relief of the myofascial pain syndrome after superficial acupuncture and traditional acupuncture treatments. A large main effect of time on pressure pain threshold of trigger points ($p < 0.001, \eta^2 = 0.577$) was observed. Pressure pain threshold increased as more treatments were applied to the participants in each group (Figure 3). No significant time * group interaction ($p = 0.136, \eta^2 = 0.053$) was shown.

3.3. Improvements in Neck Pain and Consequent Disability. The Northwick Park neck pain questionnaire is designed to show how patients’ neck pain affects their ability to manage tasks in daily life. The NPQ score did not differ significantly before and after the first treatment in either group. However, at the 2- and 4-week follow-up assessments, significant improvements ($p < 0.01, \eta^2 = 0.412$) in NPQ scores occurred in both groups. The time * group interaction was not significant ($p = 0.852, \eta^2 = 0.003$).
The data indicate that the superficial and traditional acupuncture treatments improved the consequent disability due to neck pain after a series of treatments, but the treatments were not immediately effective (Figure 4).

4. Discussion

The aim of this randomized controlled trial was to evaluate the therapeutic effect of superficial acupuncture for treating myofascial pain syndrome in the upper trapezius muscle. Direct needling in the trigger point, as in Ah shi point acupuncture in Eastern medicine or dry needling in Western medicine, has been proven as an effective therapy for myofascial pain [9, 17–20]. In many cases, superficial acupuncture has been used as a sham control [21, 22]. However, many of the clinical trials could not differentiate the therapeutic effect of true acupuncture and superficial acupuncture. A systematic review of Moffet concluded that sham acupuncture could be as efficacious as true acupuncture [23], which implies a therapeutic effect for superficial acupuncture. In the early 1980s, Baldry suggested the technique "superficial dry needling" for treating myofascial pain syndrome by inserting the needle superficially into the skin and subcutaneous tissues overlying the trigger points [12, 24]. In contrast to deep dry needling, the advantages of superficial dry needling are relative painlessness, less risk of damage to nerves and blood vessels, minimal bleeding, and a low incidence of posttreatment soreness. Baldry advocated the use of superficial dry needling for treating primary nociceptive myofascial trigger point pain [25]. A review by Kalichman et al. suggested using the superficial needling technique over areas with potential risk of significant adverse events, such as lungs and large blood vessels [26]. Triggered by hyperglycemia, chronic inflammation, micro- and macrocirculatory dysfunction, hypoxia, autonomic and sensory neuropathy, and impaired neuropeptide signaling, diabetes can lead to a slowed healing response [27]. Acupuncture is contraindicated if the diabetes is unstable. With the advantages of less risk of damage to nerves and blood vessels, superficial acupuncture should be a feasible treatment option.

The exact mechanisms of action of trigger point dry needling remain elusive. Improving blood perfusion may ease the local hypoxia due to blood vessel compression, according to the energy crisis theory. Antidromic vasodilation is seen when unmyelinated C-fibers are stimulated. The neuropeptides released from peripheral terminals induce the neurogenic inflammation and increase the blood flow in skin and muscle [28, 29]. Sato et al. suggested the contribution of calcitonin gene-related peptide to antidromic vasodilation of skeletal muscle blood flow produced by acupuncture [30]. However, several reports have demonstrated the acupuncture-induced nitric oxide generation and increased local circulation [31–34]. Furthermore, Kimura et al. suggested that nitric oxide contributes to cutaneous vasodilation induced by acupuncture stimulation, whereas the antidromic vasodilation mediated by calcitonin gene-related peptide is less important [35]. A randomized, crossover experiment by Zhang et al. investigated the impact of acupuncture needle size and needling depth on microperfusion [36]. Superficial needling with thick needle (0.40X40mm, 2mm depth) induced the greatest blood perfusion changes compared with deep needling with thick needle (0.12X40mm, 1.5cm depth), and groups with piliform needle (0.12X40mm, 2mm or 1.5cm depth). While thick needle induced greater blood perfusion changes than piliform needle, there was no significant difference among needling depth. Goh et al. suggested that future acupuncture research should take into consideration the depth of insertion. In addition, bibliometric analysis should be used [37].

Mechanical disruption of the myofascial trigger point contraction knots may lead to changes in the end-plate cholinesterase and Ach receptors and contracture of cytoskeletal structures. When stimulated, Ach nerve fibers may activate enkephalinergic, serotonergic, and noradrenergic inhibitory systems. However, these mechanisms are induced only by deep needling to the trigger points but not by superficial needling [10]. Kawakita et al. proposed the polymodal receptors as possible candidates for acupuncture and moxibustion based on the facts that polymodal receptors are responsive to chemical, thermal, and mechanical stimulation, all of which induced the analgesic effect [38, 39].

There are several limitations to this study. First, the participants were not distributed evenly throughout the population. Women and young age predominated among participants, and these characteristics may be associated with the specific responses to acupuncture. Second, no placebo or control groups were included in this study design. The natural recovery from myofascial pain syndrome or the therapeutic effects of acupuncture could not be differentiated. Third, there was no follow-up after the 4-week treatment sessions. The long-term therapeutic effects could not be examined. Fourth, all treatments were performed by the author, bias in signaling to the patients could have occurred. Furthermore, well-designed and large-scale research studies are required to verify the results of this trial.

5. Conclusions

Both superficial acupuncture and traditional acupuncture showed immediate effects on reducing the sensation of pain and increasing the pressure pain threshold over the trigger
points. The therapeutic effects increased as more treatments were applied to the trigger points during the 4-week session. Because superficial acupuncture is less painful and has minimal adverse effects, it is recommended for treating myofascial pain syndrome of the upper trapezius muscle.

Data Availability
The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest
The authors declare no conflicts of interest.

Authors’ Contributions
Chao Ching Wang and Zi Yu Chang designed the trial. Kuo Ching Chiou analyzed the data. Tse Hung Huang participated in the design of trial. Chao Ching Wang wrote the manuscript. All authors approved the manuscript.

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Supplementary Materials
CONSORT checklist of a randomized control trial. (Supplementary Materials)

References


